

Attorney Docket No. 005329 USA/MASK/RT/OR
PATENT APPLICATION

AMENDMENT UNDER 37 C.F.R. § 1.111
U.S. Appln. No. 09/876,955

REMARKS

Claims 1-34 are all the claims pending in the application.

Claim 33 stands rejected under 35 U.S.C. §112, second paragraph, as being indefinite.

Claims 1-34 stand rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1, 2, 3, 7, 12, 13, 14 and 17 of USP 6,268,093 to Kenan. Claims 1-34 stand rejected under 35 U.S.C. §102(e) as being anticipated by Kenan. Claims 1-2, 5-6, 9, 11-16, 19, and 21-22 stand rejected under 35 U.S.C. §102(e) as being anticipated by USP 6,327,033 to Ferguson. Claims 3-4, 7-8, 10, 17-18, 20 and 23-33 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Ferguson in view of USP 5,576,829 to Shiraishi et al. Claim 34 stands rejected under 35 U.S.C. §103(a) as being unpatentable over Ferguson in view of Shiraishi and further in view of USP 6,078,393 to Oohashi et al. Applicants respectfully traverse these rejections, and request reconsideration and allowance of the claims in view of the following arguments.

Applicants have amended claim 33. The limitation "said light source" has sufficient antecedent basis now.

The Examiner has rejected claims 1-34 under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1, 2, 3, 7, 12, 13, 14 and 17 of Kenan. Applicants respectfully disagree.

Claim 1 recites a method for inspecting a phase shift mask comprising the steps of acquiring a plurality of aerial images of the phase shift mask using a transmitted light, said plurality of aerial images including a first aerial image of the phase shift mask (in a first out of

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focus condition) and a second aerial image of the phase shift mask (in a second out of focus condition), and comparing said first and said second aerial images to detect phase defects and errors in the phase shift mask.

In one embodiment shown in Fig. 1 of the present application, a moving stage 2 moves a reticle 1 to have the reticle 1 scanned in a serpentine manner. The bottom surface of the reticle 1 is illuminated by light from a light source 3 via a transmission light illumination system (including a homogenizer and illumination optics 5, an illumination aperture 7, and a condenser 6). An objective 10 collects the light transmitted by the reticle 1. The light then passes through a collecting adjustable numerical aperture diaphragm 12, a lens 13, and a zoom magnification lens 14. A beam splitter 15 splits the beam to produce three images of the reticle 1. The three images of the reticle 1 in the transmitted light are simultaneously acquired by a first focus camera 16, a second focus camera 17, and a third focus camera 18.

In this embodiment, the first focus camera 16 is in focus, the second focus camera 17 is at positive defocus, and the third focus camera 18 is at negative defocus. Thus, for every field of view, three images are acquired at three different focal planes. The images captured by the second focus camera 17 (at positive defocus) and the third focus camera 18 (at negative defocus) are compared with each other to detect defects. No comparison with another die or database is required to detect phase defects.

In equating Kenan's claims and disclosure to the claimed inventions, the Examiner has construed the term "phase shift mask" broadly enough to read it on a more general claim and disclosure of reticles. Applicants submit that this is improper. While Applicants do not disagree

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that a phase shift mask can be a type of reticle, in the present situation, the property inquiry is whether a general claiming or disclosure of a reticle, given the rest of Kenan's disclosure, fairly suggests the claimed phase shift mask. The Examiner has not made out a *prima facie* case that Kenan, or any other prior art, properly providing that suggestion. As Applicants detail before, the prior art lacks such suggestion.

In Kenan, defects are detected by either comparing die to die images from the same focal plane, or comparing a dark field reflection image of a reticle to a transmission image of the same reticle (Kenan, col. 10, lines 17-21). Kenan does not teach or suggest comparing a first aerial image of a phase shift mask (in a first out of focus condition) and a second aerial image of the phase shift mask (in a second out of focus condition), both of which are transmission images.

Specifically, in Kenan, a dark field illumination system 4 is provided to obtain a dark field reflection image of a reticle 1. A splitter 15 splits the beam to produce three images of the reticle in three cameras: a first focus/dark field reflection camera 16, which is in focus; a second focus camera 17, which is at one edge of a simulated process window of an exposure system; and a third focus camera 18, which is at the other edge of the simulated process window of the exposure system (Kenan, col. 8, lines 7-10). In a transmission light illumination mode, for every field of view, three images of the reticle in the transmitted light are simultaneously acquired by camera 16, which is in focus; and cameras 17 and 18, which are at two edges of the simulated process window of the exposure system (Kenan, col. 8, lines 1-10). In the dark field illumination mode, for every field of view, three images of the reticle are acquired: two

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transmission aerial images at different focal planes produced by cameras 17 and 18; and a high resolution dark field reflection image produced by the camera 16 (Kenan, col. 9, lines 23-26).

The three streams of the image data from the three focal cameras 16, 17 and 18 are transferred to three different image processing modules for processing. In die-to-die processing mode, die to die images from the same focal plane, instead of from two different focal planes, are compared. In the transmitted-reflected mode, a dark field reflection image of the reticle and a transmission image of the same reticle, instead of two transmission images, are compared (Kenan, col. 10, lines 17-21).

Accordingly, the invention of claim 1 compares images of a phase shift mask at different focus conditions, while Kenan only teaches comparing data streams either in one image of a phase shift mask at one focus conditions, or between a reflection image and a transmission image. Kenan neither discloses nor claims the invention of claim 1. Nor is the invention of claim 1 obvious from Kenan.

Thus, claims 1-10 are patentable over Kenan under the judicially created doctrine of obviousness-type double patenting. Claims 11-22 and 23-34 are patentable over Kenan under the doctrine of obviousness-type double patenting for the same reasons.

As discussed above, because Kenan fails to teach or suggest comparing transmission images of a phase shift mask at different focus conditions, claims 1-34 are patentable over Kenan under 35 U.S.C. §102(e).

The Examiner has asserted that Ferguson teaches the invention of claim 1. Applicants respectfully disagree.

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According to claim 1, the first aerial image of the phase shift mask in a first out of focus condition and the second aerial image of the phase shift mask in a second out of focus condition are produced from the same light transmitted by the mask. As shown in Fig. 1 of the present application, the objective 10 collects the light transmitted by the reticle 1, and cameras 16, 17 and 18 produce images at different focal planes from such light. However, in Ferguson, the images are obtained separately from the very beginning.

Specifically, in Fig. 10 of Ferguson, the images are obtained by inspection optics 730 in a two pass inspection. In the first-pass inspection of the mask, the inspection optics 730 are focused above mask shapes, and in the second pass inspection, the inspection optics 730 are focused in the positive direction below mask shapes. In Fig. 11, the images are obtained in a one pass inspection by inspections optics 731 and 732 arranged serially in the moving direction of the mask. One of the two inspections optics 731 and 732 is focused in the negative direction relative to the mask, and the second is focused in the positive direction. Ferguson does not teach or suggest the first and the second aerial image of the phase shift mask produced from the same light transmitted by the mask.

Thus, Applicants respectfully submit that claims 1-2, 5-6, 9, 11-16, 19, and 21-22 are patentable over Ferguson.

Shiraishi provides a method for measuring the amount of phase shift when inspecting a phase-shifted mask. Oohashi provides a phase shift mask inspection apparatus for measuring the phase value of a phase shifter by reducing the influence of speckles. Neither of them supplies

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any of Ferguson's deficiencies. Even if one skilled in the art were to combine Ferguson, Shiraishi and Oohashi, the combination would not result in Applicants' claimed inventions.

Accordingly, Applicants respectfully submit that claims 3-4, 7-8, 10, 17-18, 20, 22-23 and 34 are patentable.

In view of the above, reconsideration and allowance of this application are now believed to be in order, and such actions are hereby solicited. If any points remain in issue which the Examiner feels may be best resolved through a personal or telephone interview, the Examiner is kindly requested to contact the undersigned at the telephone number listed below.

The USPTO is directed and authorized to charge all required fees, except for the Issue Fee and the Publication Fee, to Deposit Account No. 19-4880. Please also credit any overpayments to said Deposit Account.

Respectfully submitted,

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CERTIFICATE OF FACSIMILE TRANSMISSION

I hereby certify that this AMENDMENT UNDER 37 C.F.R. § 1.111 is being facsimile transmitted to the U.S. Patent and Trademark Office this 14th day of September, 2004.


Thea K. Wagner